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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/814,214	03/31/2004	Vincent P. Nero	CU-4973	6001

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LADAS & PARRY LLP
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CHICAGO, IL 60604

EXAMINER

SINGH, PREM C

ART UNIT	PAPER NUMBER
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1764

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/20/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/814,214

Applicant(s)

NERO ET AL.

Examiner

Prem C. Singh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 September 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 October 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

It is noted that the examiner's suggestion for a more descriptive title is not persuasive to the Applicant.

Corrected figure 1 is noted.

Specification

The disclosure is objected to because of the following informalities, as pointed out in the Office action dated: 06/28/2006.

Specifications mention Figure 3(a) and Figure 3(b) (Page 3, paragraph 12, 13). But there are no such drawings submitted with the application.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanhofer (US Patent 2,336,736) in view of Rappas et al (US Patent 6,406,616).

Claims 1 and 13.

Kanhofer invention discloses, "A process for converting low-boiling hydrocarbon distillates into stable gasoline of low olefin content with high antiknock value." (Page 1, column 1, lines 1-3). "When the higher boiling fractions of cracked gasolines are to be

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used in aviation gasoline, however, it is necessary to remove a part or all of the olefin hydrocarbons present by treating the higher boiling fraction of gasoline with a sufficient quantity of relatively concentrated sulfuric acid to effect a substantial reduction in the olefin content thereof. The preferred range is of the order of 90-100%." (Page 2, Column 1, lines 69-75; column 2, lines 1-5). "The high boiling fraction was contacted with 10 pounds per barrel (3.56 vol %, assuming a specific gravity of 0.8 for the hydrocarbon) of 98% sulfuric acid." (Page 3, column 1, lines 3-5). "After the contacting is complete, the acid and hydrocarbon mixture are separated. The reactions involved in the acid treatment are not known with any degree of certainty, because of their complexity." (Page 2, column 2, lines 19-27).

It is to be noted that polyene compounds comprise mono-, di-, and polyolefins.

Kanhofer does not specifically mention about the products of reaction of the sulfuric acid and the hydrocarbon.

Kanhofer does not specifically mention oxidizing the sulfur in the hydrocarbon phase.

Rappas invention discloses, " It has been discovered that the fuel products, such as gasoline and diesel fuel can be economically treated to reduce sulfur content to an amount of 5 to 15 ppm and not diminish the octane rating of the fuel product. In practicing the process of present invention, the hydrocarbon fuel containing low amounts of organic sulfur compounds is treated with an oxidizing solution." (Column 3, lines 25-35). "Once the extract containing the oxidized sulfur compounds is separated

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from the desulfurized hydrocarbon fuel, or raffinate, the extract can be treated to recover the acid for recycle." (Column 4, lines 15-19).

Rappas further discloses, "The invention is properly most useful for hydrocarbon fuels ready for market than for removal of sulfur from crude oil containing gross amounts of sulfur." (Column 5, lines 45-50). "This invention oxidizes almost quantitatively, organic sulfur compounds when polishing commercial diesel fuel, gasoline, kerosene, and other light hydrocarbons which have been refined, normally after hydrogenation step in a hydrotreater where sulfur compounds are reduced and removed having a small number of sulfur species which are hydrogenated with considerable difficulty." (Column 6, lines 36-44).

Since Rappas teaches an oxidative treatment of gasoline to further remove sulfur compounds, it would have been obvious to one skilled in the art at the time the invention was made to combine the teachings of Kanhofer and Rappas inventions and take a hydrocarbon stream with olefins and sulfur impurities, treat with H_2SO_4 , per Kanhofer and thus remove the olefins, and further treat with an oxidizing solution to finally produce a gasoline and/or diesel fuel with reduced olefin and sulfur content without any octane loss and thus improve the product quality economically.

Claims 2 and 17.

Kanhofer discloses, "The high boiling fraction was contacted with 10 pounds per barrel of 98% sulfuric acid." (Page 3, column 1, lines 3-5). This is equivalent to 3.56 vol %, assuming a specific gravity of 0.8 for the hydrocarbon.

Claims 3 and 18.

Kanhofer discloses, "The preferred range of acid is of the order of 90-100%." (Page 2, column 2, lines 4-5).

Claims 4 and 14.

Rappas invention discloses, " In practicing the process of present invention the hydrocarbon fuel containing low amounts of organic sulfur compounds is treated with an oxidizing solution containing hydrogen peroxide, formic acid and a maximum of about 25% water. The amount of hydrogen peroxide in the oxidizing solution is greater than about two times the stoichiometric amount of peroxide necessary to react with the sulfur in the hydrocarbon fuel." (Column 3, lines 30-39). The molar ratio of formic acid to hydrogen peroxide useful in the practice of this invention is at least 11 to 1." (Column 5, lines 30-32). "The reaction is carried out at a temperature ranging from about 50°C to 130°C." (Column 3, lines 42-44). "Some of the oxidation products, usually the corresponding organic sulfones, become soluble in the oxidizing solution, and, therefore, may be removed from the oxidized fuel by a subsequent phase separation step. The aqueous phase is removed from the hydrocarbon phase now having a

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reduced sulfur content." (Column 3, lines 57-62). "The aqueous phase is flash distilled to remove the water and acid overhead while transferring and leaving the sulfur-containing compounds in the gas oil stream at the bottom of the distillation column. The overhead stream containing acid and water from the flash distillation tower is further distilled in a separate column. The acid recovered can then be returned to the oxidizing solution." (Column 4, lines 29-37).

Claim 5.

Rappas invention discloses, "Hydrogen peroxide concentration in its broadest sense being from about 0.5 wt% to about 4 wt%. (Column 3, lines 40-42). "The oxidation/extraction solution used in the present invention will contain from about 75 wt% to about 92 wt% formic acid." (Column 5, lines 26-29).

Claim 6.

Rappas invention discloses, "The amount of oxidizing solution should be such that it contains at least about two times the stoichiometric amount to react the sulfur present in the fuel, preferably from about two to about four times. Greater amounts could be used." (Column 5, lines 54-58).

Claims 7-10.

Rappas invention discloses, "After separation, the hydrocarbon feed may be contacted with a caustic solution, or with anhydrous calcium oxide and/or passed

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through filtering devices to neutralize any trace acid remaining and to make a final dehydration of the hydrocarbon fuel." (Column 4, lines 42-50). "Some caustic or calcium oxide may be added to the fuel through line (44). Use of dry calcium oxide would not only neutralize residual acid, but would also serve to dehydrate the fuel. Use of quicklime is technically preferred to neutralization by washing with caustic solution followed by salt drying. Any solids present exit post-treatment vessel (42) through line (43) for appropriate use or disposal." (Column 9, lines 35-56).

Claim 11.

Kanhofer invention discloses, "The sulfuric acid may be recovered by well known methods and re-used where this is economical." (Page 2, column 2, lines 33-35).

Claim 12.

Rappas invention discloses, "The fuel product exits the flash drum (36) through line (38) as shown in Figure 1, is cooled in heat exchanger (40) for subsequent filtering or treatment in holding tank (41) to remove any residual water, acid, or trace sulfur compounds which may remain that are subject to removal." (Column 9, lines 30-34).

Although Rappas does not specifically mention about a coalescer, it would have been obvious to add a coalescer before the holding tank (41) to improve the separation and subsequent filtration.

Claim 15.

Kanhofer does not specifically mention using spent sulfuric acid from an alkylation process.

It would have been obvious to one skilled in the art to use a spent sulfuric acid stream from an alkylation process and thus reducing the amount of fresh acid requirement and making the overall operation more economical.

Claims 16 and 19.

Kanhofer discloses, "Any suitable method of contacting the gasoline with the acid may be used, and since such methods are well known, there is no need to describe them in detail." (Page 2, column 2, lines 5-8). Kanhofer further discloses, "Contact is preferably carried out at 0°F to 80°F." (Page 2, column 2, lines 9-11).

Kanhofer does not specifically mention about the pressure during contacting.

Kanhofer does not specifically mention the residence time needed for converting the polyene compounds to organic sulfate compounds.

It would have been obvious to one skilled in the art to use a pressure from about 10 to 50 psi and a residence time of less than about 5 minutes for an effective contacting of the gasoline and sulfuric acid, to carry out the reactions properly, and to remove olefinic compounds effectively.

Response to Arguments

Applicant's arguments filed 09/15/2006 have been fully considered but they are not persuasive.

The Applicant argues that in neither the '736 reference nor in the '616 reference, taken either singly or in combination, is there any teaching of selectively reacting polyene compounds in a hydrocarbon fuel prior to oxidative desulfurization, let alone contacting the polyene compounds with sulfuric acid amounting to 0.5-10 vol% of the hydrocarbon.

The Applicant's argument is not persuasive because reference '736 teaches, "It is necessary to remove a part or all of the olefin hydrocarbons present and according to the present invention, this is accomplished by treating the higher boiling fraction of gasoline with a sufficient quantity of relatively concentrated sulfuric acid to effect a substantial reduction in the olefin content thereof." (Page 2, column 1, lines 71-75; column 2, lines 1-2). '736 further discloses using 10 pounds per barrel of 98% sulfuric acid (which is equivalent to 3.56 vol% of the hydrocarbon) (Page 3, column 1, lines 3-5; also see Office action dated: 06/28/2006, page 5, paragraph 1).

Reference '736 also discloses, "The higher boiling fraction generally contains relatively larger amounts of sulfur compounds than the lower boiling fraction, and more over, these sulfur compounds are not as readily removed as those from the lower boiling fraction. It is not, therefore, generally feasible to refine and desulfurize the higher boiling fraction by hydrogenation." (Page 2, column 1, lines 59-68). Reference '616 on

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the other hand, discloses, "The process of this invention acts very effectively on the exact sulfur species, i.e., substituted, sterically hindered thiophenes, which are difficult to reduce by even severe hydrogenation conditions". (Column 13, lines 53-56). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify reference '736 by adding an oxidative desulfurization as suggested by reference '616. This combined invention will provide a good quality gasoline by first reducing olefins using sulfuric acid as per '736 and then reducing sulfur by oxidative desulfurization as per '616.

The Applicant argues that Rappas ('616) teaches away from the Applicant's claims stating: "the olefinic compounds which contribute to the octane rating of the hydrocarbon fuel. Octane rating is the resistance of the hydrocarbon fuel to burn. The higher the rating, the slower the burn when ignited during the compression burn cycle of the piston. Higher octane allows for better control of burning for high compression engines."

The Applicant's argument is not persuasive because the Applicant removes olefins by sulfuric acid and sulfur by oxidative desulfurization. Similarly, '736 teaches removal of olefins by sulfuric acid and the teachings of reference '616 disclose method of desulfurization without affecting octane number. '616 discloses, " Because there is little or no oxidation of olefins present, the oxidation reaction does not diminish the octane rating of the hydrocarbon." (Column 6, lines 48-50). " If the feed contains alkenes, a small percentage of the alkenes, less than 1%, might be converted to

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alcohols.” (Column 8, lines 51-53). “If alcohols are produced by the oxidation of alkenes in the feed to alcohols, the alcohols are soluble in the hydrocarbon phase.” (Column 9, lines 15-17).

The Applicant argues that claim 13 is not obvious over the cited references.

The Applicant's argument is not persuasive because all the limitations of the claim are taught by combined references '736 and '616. Please also see the response to arguments above.

The Applicant argues that the Specification points out, oxidant consumption is very large when desulfurization is applied to feeds containing large amounts of cracked, unstable compounds such as polyenes e.g. dienes. Such compounds compete strongly with the sulfur compounds for the oxidant; i.e. little sulfur oxidation takes place until almost all of the polyenes (e.g. dienes) react with the oxidant incurring highly detrimental wet chemical costs and process economics (see Applicants' application as filed at page 2, lines 10-21). Indeed the Rapas reference ('616) actually teaches away from the Applicants' teaching (see Rappas et al. column 4, lines 7-15)

The Applicant's argument is not persuasive because Rappas ('616) discloses, “The sulfur compounds react faster than the olefinic compounds and much faster than benzylic compounds. Shorter react times and better mixing would result in sulfur conversion. The extent of oxygenate formation can be directly controlled by the amount of oxidant added.” (Column 16, lines 56-61).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

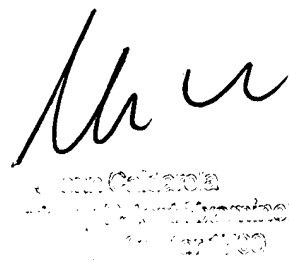
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 8:00 Am-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PS/121306

A handwritten signature in black ink is positioned above a circular official stamp. The signature appears to be 'M. W.' or similar. The stamp contains text that is mostly illegible due to fading and overlap with the signature, but it likely contains the name of the official and their title.